

# ***Headquarters U.S. Air Force***

---

*Integrity - Service - Excellence*

## **Mode S Implementation**



**OVERALL BRIEFING CLASSIFICATION:**  
**UNCLASSIFIED**

**U.S. AIR FORCE**

---



**U.S. AIR FORCE**

---

# Mode S

- **Mode S Capabilities**
- **Current Mode S Coverage**
- **European Mode S Requirements**
- **Sample Flight Plan**



# Mode S Capabilities

U.S. AIR FORCE

---

- Air surveillance upgrade to legacy Mode 3/A/C system
- Transponder provides digital *air/air* and *air/ground* datalink
- Improved accuracy and **altitude** resolution (down to 25')
- Reduced interference from closely spaced aircraft
- 5 levels of capability
  - 1: Basic capability with min features (not for ICAO)
  - 2: Elementary Surveillance (ELS) (**minimum** for ICAO)
  - 3: Enhanced Surveillance (EHS) (desired for ICAO)
  - 4/5: Extended datalink capabilities



# Mode S Capabilities

**U.S. AIR FORCE**

---

- **Each aircraft assigned a unique 24-bit “Aircraft Address” (AA)**
    - **RULE #1: No two aircraft should have the same AA!**
    - **“Default” address assigned to specific tail numbers**
    - **“Dynamic” address assigned only to military aircraft**
      - **Block of addresses to aid in day-to-day OPSEC**
      - **Distributed by DoD AIMS/PO to MAJCOMs**
      - **RULE #1 still applies!**
  - **Each aircraft uses a unique 7-character “Aircraft ID” (a.k.a. Flight ID)**
    - **Flight Plan Callsign assigned to mission (i.e. EAGLE11)**
    - **What ATC controllers see on their screens**
    - **Allows for flight plan correlation to Mode S response**
- 

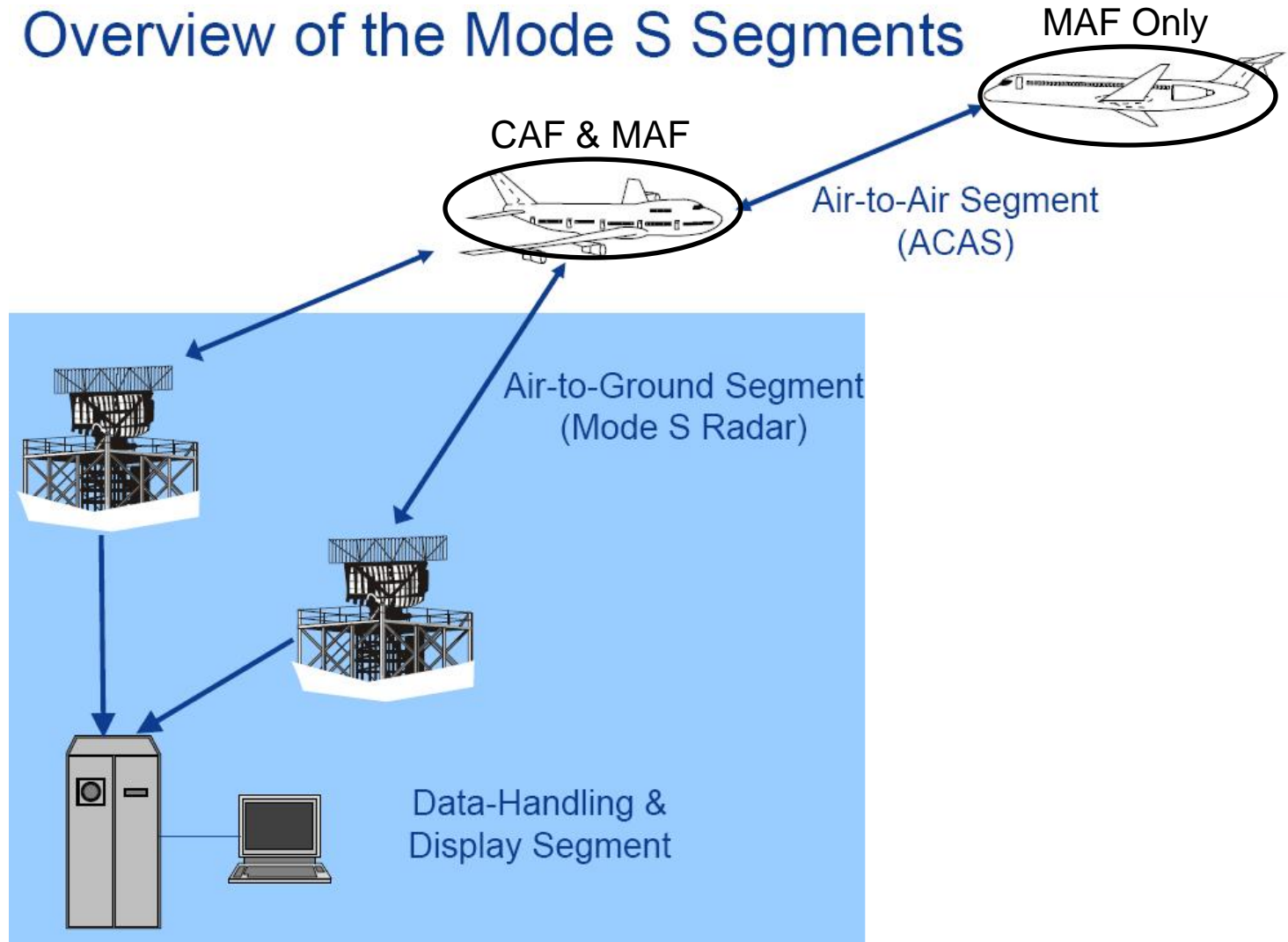
*Integrity - Service - Excellence*



U.S. AIR FORCE

# Mode S Capabilities

## Overview of the Mode S Segments



*Integrity - Service - Excellence*



**U.S. AIR FORCE**

# Mode S Capabilities

## What information is being sent?

### ■ Elementary Surveillance

1. Aircraft Address (AA)
2. Aircraft Identification (Callsign)
3. Mode 3/A Code
4. Transponder Capability Report
5. Active TCAS-II Resolution Report
6. Altitude
7. Flight Status (Air/Ground)

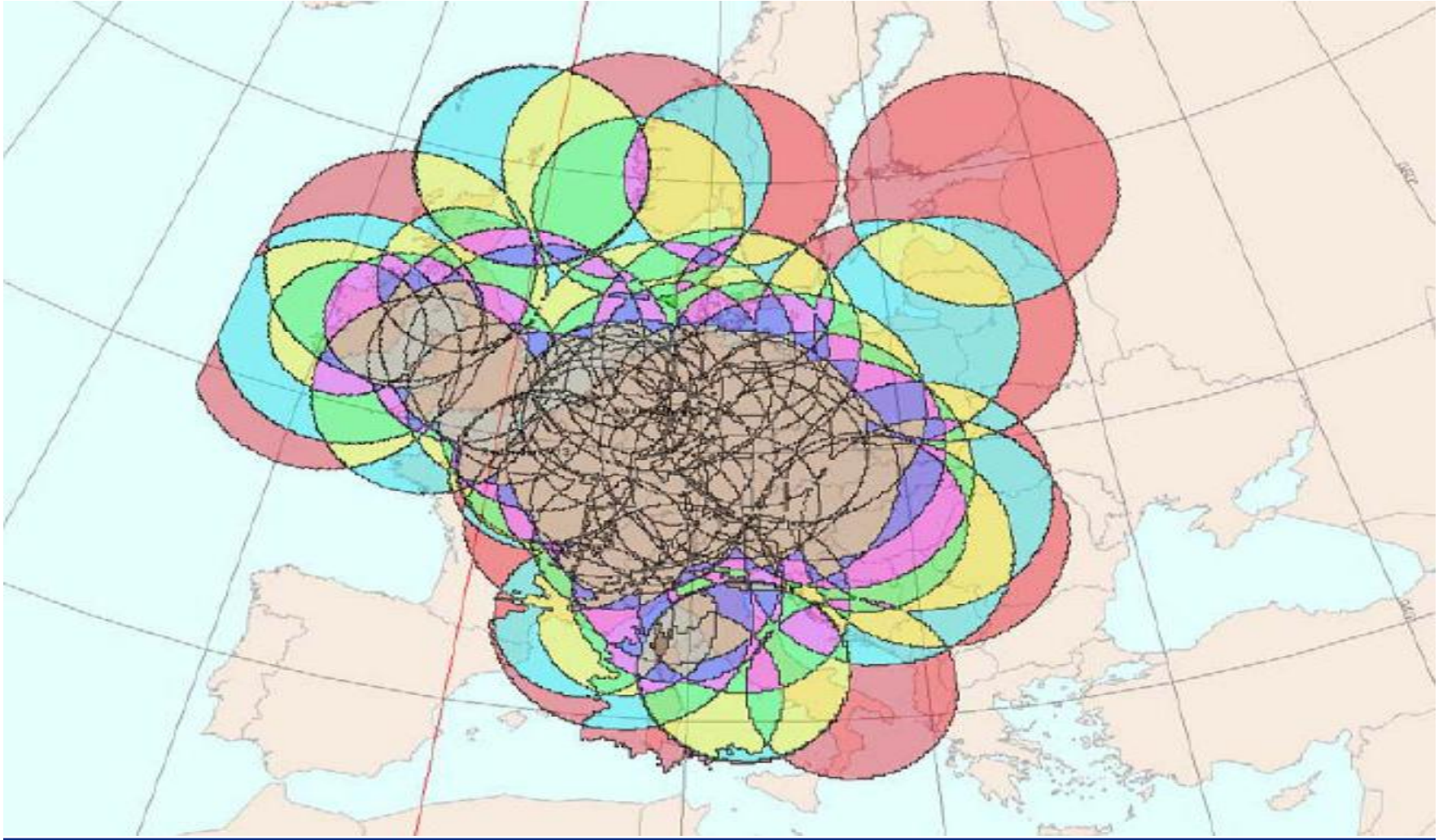
### ■ Enhanced Surveillance (ELS Plus the following)

1. Mag Heading
2. Speed (IAS/TAS/Mach No)
3. Roll Angle
4. Track Angle Rate
5. Vertical Rate
6. True Track Angle
7. Ground Speed
8. Selected Flight Level (intentions)
9. Position Information



U.S. AIR FORCE

# Current Mode S Coverage



*Integrity - Service - Excellence*



# European Requirements

U.S. AIR FORCE

---

- Currently: UK, BE, NE, LUX, GE, SWISS
- EUROCONTROL Mandate of ELS was **31 Mar 07**
  - “State” (i.e. Mil) aircraft by **31 Mar 09**
  - Mandatory yearly equipage report sent by AF/A3O
- Applies to Civil and Mil services (i.e. GAT & OAT)
  - Also applies to both IFR & VFR flight
- EHS “required” only for MAF fleet
  - Includes E-3, E-4, and EC-130
  - CAF, ISR, and helicopters only require ELS
- Usage requested once equipped to verify ATM system (both aircraft & ground stations)

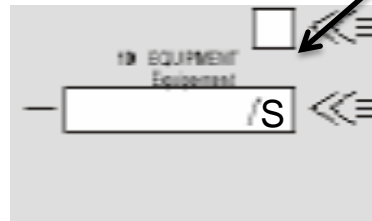




# European Requirements

U.S. AIR FORCE

- Must annotate Flight Plan (1801) correctly
- Flt Plan must match Mode S Aircraft ID (i.e. EAGLE11)
  - 7 Characters
  - No **spaces** before or in between **only after**
  - Equipment code: /S
  - Mode S w/ Pressure Alt & Flight ID transmit



FLIGHT PLAN PLAN DE VOL	
PRIORITY Priorité FF	ADDRESSEE(S) Destinataire(s)
FILING TIME Heure de dépôt	ORIGINATOR Avaliseur
SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR Identification précise du (des) destinataire(s) et/ou de l'expéditeur	
3 MESSAGE TYPE Type de message FPL	7 AIRCRAFT IDENTIFICATION Identification de l'aéronef
5 NUMBER	8 FLIGHT RULES Règles de vol
13 DEPARTURE AERODROME Aérodrome de départ	10 EQUIPMENT Équipement
15 CRUISING SPEED Vitesse croisière	16 DESTINATION AERODROME Aérodrome de destination
LEVEL Niveau	17 OTHER INFORMATION Autres renseignements
ROUTE Route	18 SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES) Renseignements complémentaires (À NE PAS TRANSMETTRE DANS LES MESSAGES DE PLAN DE VOL DÉPOSÉ)
TOTAL EST Durée totale estimée	19 ENDURANCE Autonomie
ALTITUDE AERODROME Aérodrome de décollage	PERSONS ON BOARD Personnes à bord
2ND ALTITUDE AERODROME 2 <sup>e</sup> aérodrome de décollage	EMERGENCY RADIO Radio de secours
JACKET/SWITCHES OF SAFETY Jackets/Interrupteurs de sécurité	
NUMBER Nombre	
CAPACITY Capacité	
COVER Couverture	
COLOUR Couleur	
AIRCRAFT COLOUR AND MARKINGS Couleur et marques de l'aéronef	
REMARKS Remarques	
PILOT IN COMMAND Pilot-commandant de bord	
FILED BY / Déposé par	
SPACE RESERVED FOR ADDITIONAL REQUIREMENTS Espace réservé à des besoins supplémentaires	